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Topological defects of Néel order and Kondo singlet formation for Kondo-Heisenberg model on a honeycomb lattice[1] QIMIAO SI, Rice University, PALLAB GOSWAMI, National High Magnetic Field Laboratory and Floria State University — Heavy fermion systems represent a prototypical setting to study magnetic quantum phase transitions. In this context, we study the spin one-half Kondo-Heisenberg model on a honeycomb lattice at half filling [1]. The problem is approached from the Kondo destroyed, antiferromagnetically ordered insulating phase. We describe the local moments in terms of a coarse grained quantum nonlinear sigma model, and show that the skyrmion defects of the antiferromagnetic order parameter host a number of competing order parameters. In addition to the spin Peierls, charge and current density wave order parameters, we identify for the first time Kondo singlets as the competing dual orders of the antiferromagnetism, which can be related to each other via generalized chiral transformations of the underlying fermions. We also show that the conduction electrons acquire a Berry phase through their coupling to the hedgehog configurations of the Néel order, which cancels the Berry phase of the local moments. Our results demonstrate the competition between the Kondo-singlet formation and spin-Peierls order when the antiferromagnetic order is suppressed, thereby shedding new light on the global phase diagram of heavy fermion systems at zero temperature.

[1] P. Goswami and Q. Si, arXiv: 1309.0501

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